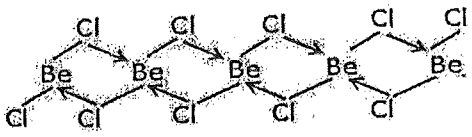
(ii)

Potassium	Lilac flame or purple flame
Strontium	Deep bright red flame

(iii) A: $LiNO_{3(s)} \rightarrow Li_2O_{(s)} + 4NO_{2(g)} + O_{2(g)}$ **OR** $6Li_{(s)} + N_{2(g)} \rightarrow 2Li_3N_{(s)}$.

$Li_2CO_{3(s)} \rightarrow Li_2O_{(s)} + CO_{2(g)}$ **OR** $2LiOH_{(s)} \rightarrow Li_2O_{(s)} + H_2O_{(l)}$.

B: $Be + Cl_2 \rightarrow (BeCl_2)_n$; polymer 

OR $BeO_{(s)} + 2OH^-_{(aq)} + H_2O_{(l)} \rightarrow Be(OH)_4^{2-}{}_{(aq)}$.

OR $Be + 2OH^- + 2H_2O \rightleftharpoons Be(OH)_4^{2-} + H_{2(g)}$

$Be(OH)_{2(s)} + 2OH^-_{(aq)} \rightarrow Be(OH)_4^{2-}{}_{(aq)}$.

(b) (i)

Element	Li	Be	B	C	N	O	F	Ne
Stable oxide	Li_2O	BeO	B_2O_3	CO_2	NO_2	O_2	F_2O	-

(ii) $Li_2O_{(s)} + H_2O_{(l)} \rightarrow 2LiOH(aq)$.

$CO_{2(g)} + H_2O_{(l)} \rightleftharpoons H_2CO_{3(aq)}$.

Element	Li	Be	B	C	N	O
Formula of chloride	LiCl	$BeCl_2$	BCl_3	CCl_4	NCl_3	Cl_2O
Bond type	ionic	covalent	covalent	covalent	covalent	covalent

(iii) LiCl is ionic and the rest are covalent.

(c) (i) $SiCl_{4(l)} + 2H_2O_{(l)} \rightarrow SiO_{2(s)} + 4HCl_{(g)}$.

$SiCl_{4(l)} + 4H_2O_{(l)} \rightarrow SiO_2.2H_2O_{(s)} + 4HCl_{(g)}$.

$SiCl_{4(l)} + 4H_2O_{(l)} \rightarrow Si(OH)_{4(s)} + 4HCl_{(g)}$.

$PbCl_{4(l)} + 2H_2O_{(l)} \rightarrow PbO_{2(s)} + 4HCl_{(g)}$.

(ii)

Element	Silicon	Lead
Formula of oxide	SiO_2	PbO_2
Acid base character	Acidic	Amphoteric

d) Ammonia (NH_3) is oxidised at 700 – 900°C in the presence of Pt/Rh catalyst to form nitrogen monoxide (NO).

$4NH_{3(g)} + 5O_{2(g)} \rightarrow 4NO + 6H_2O$ (conditions Pt/Rh at 700°C)

The NO reacts with oxygen (air) to form NO_2.

$2NO_{(g)} + O_{2(g)} \rightarrow 2NO_2$

The NO_2 is then dissolved in water in the presence of excess oxygen to form nitric acid.

$4NO_{2(g)} + 2H_2O + O_{2(g)} \rightarrow 4HNO_3$

ORGANIC CHEMISTRY

SET 1 SECTION C (CGCEB 2009)
Organic Chemistry

7. (a) (i)

	C	H
	$\frac{0.86}{12} = 0.0717$	$\frac{0.14}{1} = 0.1400$
	$\frac{0.0717}{0.0717} = 1$	$\frac{0.14}{0.0717} = 1.95 \approx 2$
Empirical formula $=CH_2$		

(ii) An alkene. When an alkene is treated with acidified water, alcohol is obtained. When the alcohol is treated with conc.H_2SO_4 at 170°C the same alkene is obtained. The empirical formula is C_nH_{2n}

(iii)

mass of alcohol(B) − mass of water = mass of A

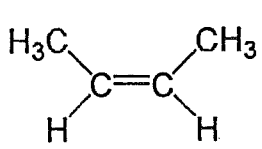
mass of A $= 74 - 18 = 56 gmol^{-1}$

(iv) $(CH_2)n = Mf \Longrightarrow (12 + 2)n = 56$

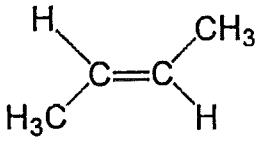
$\Longrightarrow (14)n = 56$

$$n = \frac{56}{14} = 4 \Longrightarrow Mf = C_4H_8$$

(v)



cis-but-2-ene



trans-but-2-ene

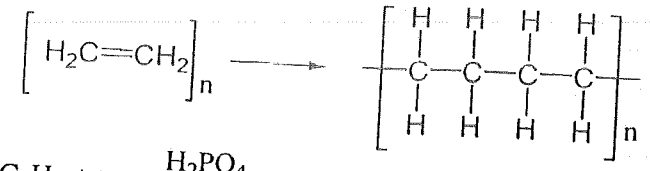
(b) (i) The splitting of long chain hydrocarbon of less volatility to shorter chain hydrocarbon of high volatility using heat or in the presence of a catalyst.

(ii) $C_{10}H_{22} \xrightarrow[\Delta]{} C_2H_4 + C_8H_{18}$

$C_5H_{12} \xrightarrow[\Delta]{} C_2H_4 + C_3H_8$

$C_2H_6 \xrightarrow[\Delta]{} C_2H_4 + H_2$

(iii)



$$C_2H_4 + H_2O \xrightarrow[300^0C]{H_2PO_4} CH_3CH_2OH$$

(iv) Polyethene is non-biodegradable thus it will litter around to causes soil and water pollution Combustion of ethanol produces carbon dioxide which causes greenhouse effect, depletion of the ozone layer.

(c) (i) $PBr/H_3PO_4, H^+/Cr_2O_7^{2-}$ or $H^+/KMnO_4$

$H_2O/H_2SO_4, H^+/Cr_2O_7^{2-}$ or $H^+/KMnO_4$

Pentan-2-one or pentan-3-one

(ii) Dehydration of pentan-2-ol ($CH_3CH(OH)CH_2CH_2CH_3$) with concentrated sulphuric acid at 180°C

$$CH_3CH(OH)CH_2C_2H_5 \xrightarrow[180^0C]{H_2SO_4} CH_3CH{=}CHC_2H_5$$

Reflux of 3-bromopentane with concentrated alkaline (NaOH, KOH) in alcohol (ethanol)

$$CH_3CH_2CHBrC_2H_5 \xrightarrow[\text{ethanol(alcohol)}]{\text{conc.KOH}} CH_3CH{=}CHC_2H_5$$

reflux

(iii) Decolourised bromine in carbon tetrachloride or bromine water from reddish brown to colourless.

Decolourised alkaline potassium permanganate from purple to colourless.

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8. (a) (i) $C_nH_{2n+1}OH$

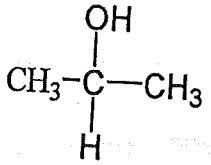
(ii) CH_3OH, CH_3CH_2OH

(iii) SP^3 hybridisation

(iv) Tetrahedral shape

(b) (i) Propanoic acid

(ii) (C)



(D)

(iii) Step 4 (A to E). Reagent; excess conc. $H_2SO_4/170 - 180^0C$

(iv) Step 1 (A to B) reagent; $H^+/KMnO_4$; warm

(v) CHI_3 triiodomethane

(c) (i) *To prevent the solvent from evaporating since organic compounds are volatile

*To prevent flammability since most organic compound C_3H_7X is Volatile

*To prevent flammability since most organic compounds are flammable and toxic

(ii) Step1: Protonation of the hydroxyl group of alcohol to form $C_3H_7O^+H_2$

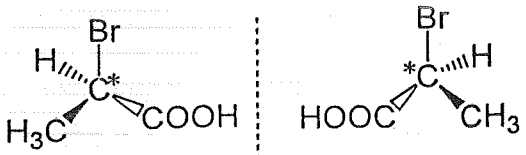
Step2: Lost (elimination) of water molecule to form a carbocation ($C_2H_7C^+$)

Step 3 Attack of carbocation $C_2H_7C^+$ with X^- ion

(iii) SN^2 reaction mechanism Or nucleophilic substitution reaction bimolecular

(d) (i) Bromine (Br_2)/heat.

(ii)



9. (a) The enthalpy of hydrogenation of benzene is lower than expected. X-ray crystallography shows that all the bonds in benzene have the same length.

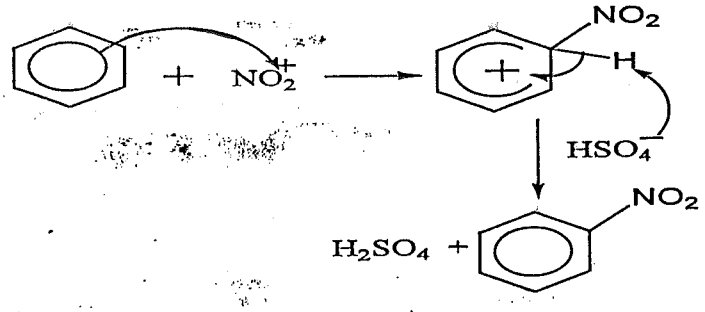
(b) (i) NO_2^+

(ii) conc. H_2SO_4 and conc. HNO_3

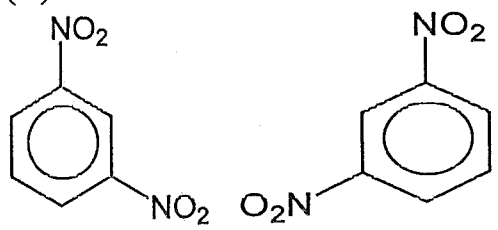
Condition: 55 to 60°C

(iii)

$$H_2SO_4 + HNO_3 \rightarrow NO_2^+ + 2HSO_4^- + H_3O^+$$



(iv)



The nitro group is an electron withdrawing group (deactivating group). This group makes positive charge to concentrate in the ortho and the para position of the benzene ring making only the meta position to be richer in electrons. Thus the incoming nitro group is directed to the meta position.

(c) (i) Sn/Conc. HCl

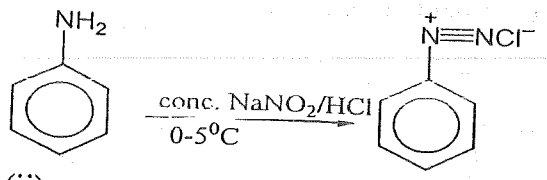
(ii) Because of the presence of the lone pair of electrons on the nitrogen atom in amine which can be donated to a Lewis acid.

(iii) Steam distillation

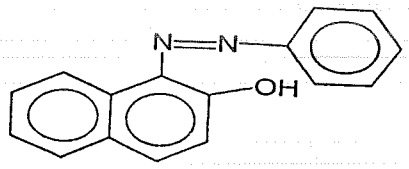
(iv) $CH_3CONH_2 < C_6H_5NH_2 < CH_3NH_2$

the alkyl group in CH_3NH_2 donates its electron to the nitrogen atom by positive inductive effect. This increases the ability of nitrogen to donate it lone pair of electron. In $C_6H_5NH_2$ the lone pair of electron is delocalised in the benzene ring while in CH_3CONH_2 the lone pair of electron is delocalise to the carbonyl group and so is difficult to protonate.

(d) (i)



(ii)



(iii) Coupling reaction

(iv) It is a colour compound, a dye and a colorant.

SET 2: SECTION C (CGCEB 2010)
Organic Chemistry

7. (a)(i) B and D

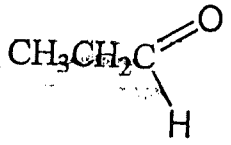
(ii) B and C or C and D

(b) C_4H_9OH = butan − 2 − ol

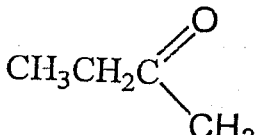
(c) (i) A (ii) D

(d) A white fume will be observed immediately and 2-chloro-2-methylpropane $CH_3CCl(CH_3)CH_3$ will be formed

(e) (i) (A) propanal



(B) Butanone



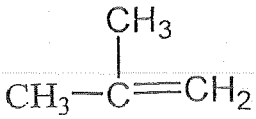
butanone

(ii) Butanone will give a yellow precipitate of CHI_3 with $NaOH/I_2$ (iodoform reagent) while propanal will not

Or Propanal will give a silver mirror with ammoniacal silver nitrate ($NH_3/AgNO_3$) solution while Butan-2-one will not

Or Propanal will reduce copper(II) ion in Fehling's solution to a red precipitate of copper(I) oxide while butan-2-one will not

(f)



2-methylpropene

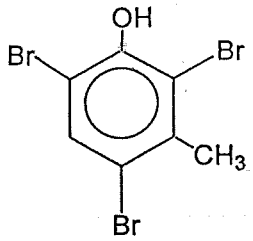
(g) (i) A will have the highest boiling point because of increase in the strength of van der waal force due to less branching.

(ii) Use as a solvent. The solvent must always be dry and alcohol free.

(h)

A $CH_3CH_2CH_2OH + HOBr \longrightarrow$ No reaction

B



2,4,6-tribromo-3-methylphenol

E will give a white precipitate of 2,4,6-tribromo-3-methylphenol with bromine water

---

8. (a) Empirical formula shows the simplest ratio of each kind of atom in a compound while molecular formula shows the actual number of each kind of atom in a compound.

(b) (i) % of oxygen (100-(70.8+4.1+6.2) = 18.9%

	C	H	N	O
	$\frac{70.8}{12} = 5.9$	$\frac{6.2}{1} = 6.2$	$\frac{4.1}{14} = 0.293$	$\frac{18.9}{16} = 1.151$
	$\frac{5.9}{0.293} = 20$	$\frac{6.2}{0.293} = 21$	$\frac{0.293}{0.293} = 1$	$\frac{1.151}{0.293} = 4$
Emperical formula=$C_{20}H_{21}NO_4$				

(ii) $(Ef)n = Mf \Longrightarrow (C_{20}H_{21}NO_4)n = 339$

$(20 \times 12 + 21 \times 1 + 14 + 16 \times 4)n = 339$

$(339)n = 339 \Longrightarrow n = 1$

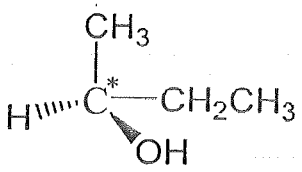
$Mf = C_{20}H_{21}NO_4$

(iii) The two formulae are the same.

(c) (i) $CH_3CHClCH_2CH_3 = 2-$ chlorobutane

(ii) $CH_3CH(OH)CH_2CH_3$, butan $-2-$ ol

(iii)



The carbon atom with an asterisk (*) is an asymmetric carbon

(iv) But-2-ene

(d)

Reagent	Structure of product	Types of reaction
$NaBH_4$	CH_3CH_2OH	Reduction
HCN(aq)	$CH_3CH(OH)CN$	Nucleophilic addition
Acidified MnO_4^-	CH_3COOH	Oxidation

9. (a) (i)

(ii) SP^2 hybridised

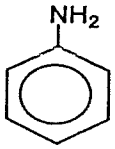
(b) **(i) Reagent:** $Cl_2/AlCl_3$ **Condition:** reflux with lewis acid **Types of reaction:** electrophilic substitution

(iii) 1,2,3,4,5,6-hexachlorobenzene

(c) **Reagent:** ConcHNO_3/Conc. H_2SO_4 **condition:** 55-60°C, concentrated acid

Types of reaction: electrophilic substitution

(d) Phenylamine (aniline)



(e) (i) (x) $NaBr/H_3PO_4$ or HBr and (y)Dilute NaOH

(ii) (A) $CH_3CH = CHCH_3$

(B) $CH_3CH_2CHBrCH_3$

(C) $CH_3CH_2CH(OH)CH_3$

(iii) The colour of dichromate changes from orange to green.

Reasons: This is because chromate(VI) is reduced to Chromate(III)

(iv) CH_3CH_2COOH or $CH_3CH_2COO^-$or CH_3CH_2COONa

(v) Use to test for methyl carbonyl (CH_3CO-) or methyl alcohol ($CH_3CH(OH)$-R)

SET 3: SECTION C (CGCEB 2011)

Organic Chemistry

7. (a) (i)

C	H	N	O
$\frac{46.6}{12} = 3.88$	$\frac{8.74}{1} = 8.74$	$\frac{13..6}{14} = 0.97$	$\frac{31.1}{16} = 1.94$
$\frac{3.88}{0.97} = 4$	$\frac{8.74}{0.971} = 9$	$\frac{0.97}{0.97} = 1$	$\frac{1.94}{0.97} = 2$
Ef= $C_4H_9NO_2$			

(ii)

$$(Ef)n = Mf$$
$$\Rightarrow (12 \times 4 + 1 \times 9 + 14 \times 1 + 16 \times 2)n = 103$$
$$\Rightarrow (103)n = 103$$
$$\Rightarrow \frac{103}{103} = n \Rightarrow n = 1$$
$$\Rightarrow Mf = C_4H_9NO_2$$

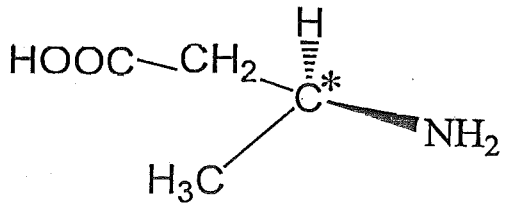
(b) Portion of the organic substance is heated strongly sodium in dry ignition test tube. The hot tube is plunged in cold water. Any nitrogen present is converted to NaCN. Iron(II) sulphate is added and boiled, followed by few drops of iron(III) chloride, acidified HCl. The appearance of a greenish blue precipitate of iron(III)hexacyanoferrate(II) indicates the presence of nitrogen

(c) (i) It is an atom or group of atoms or a bond that determine the chemical properties of an organic compound in a particular family.

(ii) -COOH

(iii) NH_2-CH(CH_3)CH_2COOH

(d)



3-aminobutanoic acid

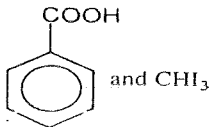
(e) The compound is treated with nitrous acid (mixture of $NaNO_2$ and HCl) which causes the release of nitrogen gas.

*If treated with potassium (or sodium) hydroxide in alcoholic medium in trichloromethane and a nasty smell like that of a rotten fish is observed, it means it contain primary amino group.

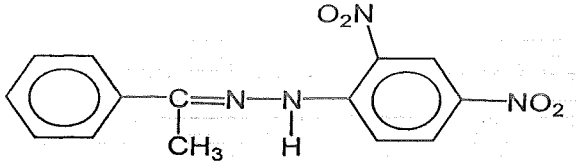
(f) (i) $AlCl_3$ or $FeCl_3$, Condition: Heat under reflux

(ii) To avoid the hydrolysis of ethanoyl chloride to ethanoic acid.

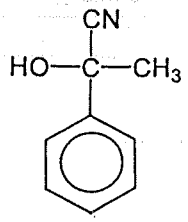
(iii) (A) benzoic acid and triiodomethane



(B) phenylacetone-2,4-dinitrophenylhydrazone



(C) 2-hydroxyl-2-phenylpropanonitrile



2-hydroxy-2-phenylpropanenitrile

(iv) (A) from equation,

$$80.5g\ of\ ethanoyl\ chloride \longrightarrow 120g\ of\ phenylacetone$$

$$\Rightarrow 2g\ will\ give\ \frac{120x2}{80.5} = 2.98g$$

(B) $$\%yield = \frac{actual\ yield}{theoretical\ yield} x100$$

$$= \frac{1.95}{2.98} = 65.4\%$$

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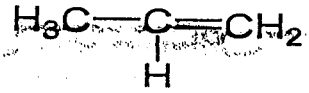
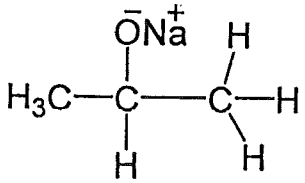
8. (A) $CH_3CH = CH_2$ (propene)



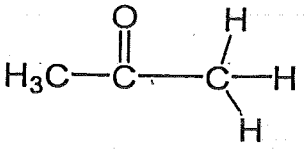
(B) $CH_3CHBrCH_3$

(C) $CH_3CH(OH)CH_3$

(D)



(E)



(ii) HBr

(iii) The purple colour of potassium permanganate changes to colourless

(iv)